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Your ref/letter: My ref/letter: 74392WO Date: 4 Feb 2004

International Patent Application No. PCT/EP03/02575
Title: "Optical device for the automatic loading and unloading of containers onto vehicles"
Applicant: Gottwald Port Technology GmbH

In reply to the first preliminary international examination notice of 6 October 2003:

With this examination notice, novelty is denied to the present invention according to the current claims 1 through 19 in regard to the citation D1 – EP 1 043 262 A1 – and the existence of sufficient inventive activity is denied in regard to a combination of citation D1 with citation D2 – WO 01/81233 A1.

In order to continue with the preliminary international examination process, new claims 1 through 18 are submitted for the records in handwritten corrected form and in clean form, and we ask that you use them as the basis for the further examination process.

In regard to citation D1, which we, also in agreement with the examiner, consider to be the closest state of the art, the independent claims 1 and 2 have been limited by incorporating the corresponding features of the originally submitted claim 7. The original claims 8 through 19 then follow the original claims 3 through 6 as the new claims 7 through 18.

Thus, the new claim 1 as well as the new claim 2 contain a more precise definition of the position coordinates of the loading platform and the container, as determined by the camera system, which are essentially comprised of the vertical position of the loading platform and the container, and also the intersection of the diagonals of the identification points of the loading platform and the container in the form of their fastening means. This choice of the position coordinates enables a favorable and thus time-saving positioning of the automatic stacker crane with the container above the loading platform, or that of the empty automatic stacker crane above the container being emptied.

In regard to the unloading process, it is furthermore advantageous to define the upper edge of the identification points (fastening means) of the container as an element of the position coordinates. In this way, it is also possible to unload standard containers with no lid, such as open-top containers, tank containers, and/or flat containers.

Due to the above-described defining of the position coordinates according to the invention, especially in terms of their intersection of diagonals, it then becomes especially easy to move the load suspension device with or without container into the reach of the loading platform or of the container being unloaded (see current claim 10). The load suspension device is simply moved such that the intersection of the diagonals of the fastening means of the container or of the loading platform lies plumb above the intersection of the diagonals of the fastening means of the loading platform or of the container, respectively. Any required fine positioning of the container or the load suspension device can then take place by simple rotary movement of the load suspension device about the aforesaid plumb line. No other travel motions of the stacker crane or its trolley are necessary. This procedure simplifies the positioning of the load suspension device and thus contributes to reducing the loading and unloading time.

Furthermore, a new specification page 2a is submitted for the records, containing an assessment of the two main citations D1 and D2. New specification pages 2 through 14 are also submitted for the record in handwritten corrected form, in which the description of the advantages has been adapted to the current version of the claims. Since as a result of this the number of pages has been changed, a clean copy of the entire specification in triplicate is submitted for the record as an additional enclosure, and we ask that you use this as the basis of the further examination process.

It is hoped that, on the basis of the now available documentation, a positive preliminary international examination report can now be issued. If any further reservations should exist with regard to the patentworthiness of the present invention, we ask that you send us notice thereof, so that a clearing up of the concerns can still be undertaken before the preliminary international examination report is issued.

[signature]
Dipl.-Ing. Jörg Moser
Patent Attorney

Encl.
New patent claims 1 to 18 in handwritten corrected form;
New patent claims 1 to 18 in clean copy (triplicate);
New specification pages 2 to 14 in handwritten corrected form,
New specification pages 2a in clean copy,
New specification pages 1 to 19 in clean copy (triplicate)

New Patent claims 1 to ~~19~~

1. Method for load transfer in a container storage space for standard containers, with a stacker crane for the containers servicing the container storage space, controllable by a DP system of a logistical management, which can travel between a storage place for each container and a loading platform of a transport vehicle of a container that can travel in the area of the container storage space, wherein the stacker crane has a load suspension device for depositing the container on the loading platform, which can be oriented with respect to it,
characterized by the sequence of the following work steps when loading the transport vehicle:

a) the transport vehicle is identified and the data generated in this way are transmitted to the DP system of a logistical management,

b) by means of a calibrated camera system, defined identification points are detected on the loading platform of the transport vehicle and their coordinates are transmitted to the logistical management DP system,

c) the logistical management DP system compares the coordinates of the identification points against the data of the container being loaded as stored in the DP system and determines the fastening means to be assigned to this container and position coordinates on the loading platform of the transport vehicle,

d) the stacker crane drives under computer control with the container to be loaded above the loading platform of the transport vehicle, exactly congruent and above the position coordinate, wherein 1< >1,

e) by means of a calibrated camera system arranged on the stacker crane, the fastening means of the loading platform are detected and the container is moved if necessary so that the fastening means of the container stand congruently above the coordinated fastening means of the loading platform,

f) the container is set down on the loading platform of the transport vehicle such that the fastening means of the container and the coordinated fastening means of the loading platform mate together at the end of the setdown process.

2. Method for load transfer in a container storage space for standard containers, with a stacker crane for the containers servicing the container storage space, controllable by a DP system of a logistical management, which can travel between a storage place for each container and a loading platform of a transport vehicle of a container that can travel in the area of the container storage space, wherein the stacker crane has a load suspension device for picking the container up from the loading platform, which can be oriented with respect to it,
characterized by the sequence of the following work steps in the unloading of a transport vehicle:

a) the transport vehicle and the container being unloaded are identified and the data generated in this way are transmitted to the DP system of a logistical management,
b) by means of a calibrated camera system, defined identification points of the container are detected and their coordinates are transmitted to the logistical management DP system,
c) the logistical management DP system determines, from the identification points, the fastening means and position coordinate of the container,
d) the stacker crane drives under computer control above the container, exactly congruent and above the position coordinate, wherein the position coordinate 2< >2,
e) by means of a calibrated camera system arranged on the stacker crane, the fastening means of the loading platform of the container are detected and the load suspension device is moved if necessary so that the fastening means of the load suspension device of the stacker crane stand congruently above the coordinated fastening means of the container,
f) the load suspension means is brought up to the container such that the fastening means of the load suspension means and the fastening means of the container mate together.

3. Method per claim 1 or 2, characterized in that the transport vehicle or the container being unloaded is identified by means of a camera system.

4. Method according to one of claims 1 to 3, characterized in that, in order to detect the coordinates of the identification points of the loading platform or the identification points of the container, an operator, supported by a user-defined interface on a monitor screen of the logistical management DP system, uses a marking mechanism to select the identification points of the loading platform or the identification points of the container on the user-defined interface.

5. Method according to one of claims 1 to 4, characterized in that the coordinates of the identification points of the loading platform or the identification points of the container are automatically detected by a computer system and transmitted to the logistical management.

6. Method according to one of claims 1 to 5, characterized in that the detection of the coordinates of the loading platform of the transport vehicle occurs in its loading and unloading zone and that of the coordinates of the loading platform of the container occurs in its loading and unloading zone.

~~7. Method according to one of claims 1 to 5, characterized in that~~ 1<the position coordinate ~~are~~ is described by the vertical position of the loading platform and by the point of intersection of the diagonals of the identification points of the loading platform, which ~~describe~~ describes the absolute target position of the container>1 ~~or~~ 2<is described by the vertical position of the upper edge of the identification points of

the container and by the point of intersection of the diagonals of the identification points of the container, which ~~describe~~ describes the absolute target position of the load suspension means.>2

8. 7. Method according to one of claims 1 to 6, characterized in that detection of the coordinates of the loading platform of the transport vehicle or the coordinates of the container occurs in the identification zone.

9. 8. Method according to one of claims 1 to 8 7, characterized in that the vertical position of the loading platform and the point of intersection of the diagonals of the identification points of the loading platform or the vertical position of the upper edge of the identification points of the container and the point of intersection of the diagonals of the identification points of the container describe the relative target position of the container.

~~10~~. 9. Method according to one of claims 1 to ~~9~~ 8, characterized in that the position coordinate is described by the absolute target position of the container or of the load suspension device, which is composed of the coordinates of the transport vehicle located in the parking position as detected by means of a camera and the relative target position of the container or of the load suspension device.

~~11~~ 10. Method according to one of claims 1 to ~~10~~ 9, characterized in that the stacker crane is moved into reach of the loading platform or of the container in such a way that the point of intersection of the diagonals of the fastening means of the container or the load suspension device stands congruently plumb above the point of intersection of the diagonals of the fastening means of the loading platform or the container.

~~12~~ 11. Method according to one of claims 1 to ~~11~~ 10, characterized in that a second user-defined interface has four quadrants, each representing a pair of fastening means, and each pair consists of one fastening means of the loading platform or of the container, projected by an image of the camera system, and of the coordinated fastening means of the container or the load suspension device, projected by a superimposing of a computer-calculated contour of the container or of the load suspension means and of the fastening means of the container or of the load suspension means onto the image.

~~13~~ 12 Method according to one of claims 1 to ~~12~~ 11,characterized in that any deviation in position of the container being loaded from the position of the loading platform or the position of the load suspension device from the position of the container being unloaded can be determined in the logistical management DP system for a fine-tuned positioning, in that the second user-defined interface of logistical management has a marking mechanism, with which the operator selects at least one identification point of the loading platform or of the container.

~~14~~ 13. Method according to one of claims 1 to ~~13~~ 12, characterized in that any deviation in position of the container being loaded from the position of the loading platform or in the position of the load suspension device from the position of the container being unloaded is automatically recognized by a computer system for the fine positioning.

~~15~~ 14. Method according to one of claims 1 to ~~14~~ 13, characterized in that, if there is any deviation in position of the container being loaded from the position of the loading platform of the container or in the position of the load suspension device from the container being unloaded, the load suspension device is rotated so that the fastening means of the container stand congruently plumb above the fastening means of the loading platform, or the fastening means of the load suspension device stand congruently plumb above the fastening means of the container.

~~16~~. 15. Method according to one of claims 1 to ~~15~~ 14, characterized in that the setting down and releasing of the container from the load suspension device or the setting down of the load suspension device of the stacker crane onto the container is guided by the operator until the fastening means mate with each other.

~~17~~. 16. Method for adjusting the position of a stacker crane in a container storage space, to implement the method according to one or more of claims 1 or 2, as well as 3 to ~~16~~ 15, with a camera system fastened on the stacker crane for detection of the position of containers being handled, with an absolute length measuring system to detect the position of the stacker crane, characterized by the sequence of the following work steps, making use of precalibrated cameras:

a) the stacker crane travels above a reference point arranged at any given position within the container yard, so that at least one camera of the camera system detects the reference point,
b) the logistical management DP system compares the position of the reference point with the memorized position of the reference point and determines an offset when any deviation exists.

~~18~~ 17. Method per claim ~~17~~ 16, characterized in that the container yard has several reference points, which can be detected by the cameras of the stacker crane.

~~19~~ 18. Method for adjusting the position of a camera, which is arranged on a stacker crane, which is located in a container yard, for implementing the method according to one or more of claims 1 or 2, as well as 3 to ~~16~~ 15, with a camera system fastened to the stacker crane for detecting the position of containers being handled, with an absolute length measuring system for detecting the position of the stacker crane, characterized in that the container yard has a super-reference point and a camera is arranged on the stacker crane that can be adjusted relative to it by means of the super-reference point.

[start of handwritten German correction pages] 2

... the transport vehicle and vice versa. The stacker crane can be an automatic container stacker crane (ACS), or also a gantry crane or a one-legged gantry crane. Thus far, the placement of the container onto a means of transport by the stacker crane has been manually controlled. The stacker crane consists of a bridge and a trolley which can travel on it, while the bridge can travel on rails. The placing of the container suspended from the crane onto a transport vehicle is manually controlled by an operator. For the loading, an operator present in the parking position drives the container by means of the stacker crane into the vicinity of the transport vehicle, and then by slow "approach" he positions the container exactly on the transport vehicle. The approach involves repeated left/right and forward/backward moving of the ACS, as well as the lowering of the container, controlled and monitored by the operator on site. Likewise, when unloading the transport vehicle, the stacker crane is slowly brought up to the container manually by an operator, so that the crane can pick it up.

The large number of containers handled within a container yard necessitates a smooth, error-free, speedy, economical and long-lasting work process. In addition, it is desirable to increase the throughput of containers, i.e., the number of containers handled per unit of time. This will reduce the parking time for containers inside the container yard, the layover time for container ships, and the stopping time for the land transport vehicles. At the same time, this implies a shortening of the length of transport for the containers.

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The underlying problem of the invention is to achieve a high throughput of containers within a container yard, to lower the costs and to reduce the down time in case of defects, while at the same time boosting the economy of the container handling yard.

This problem is solved according to the invention by the indicated method for loading of transport vehicles with standard containers per claim 1, by the indicated method for unloading of transport vehicles with standard containers per claim 2, and by the indicated methods for adjusting the position of a stacker crane according to claims 17 and 19.

One benefit of the invention is the quick and flawless handling of the loading and unloading process of transport vehicles, made possible by automation. In the present application, the constantly recurring identical loading and unloading sequences are broken down into work steps and each of them is automated. The sequence of individual automated work steps with no interruption in time, such as require a shorter time to accomplish than the manual steps, and the mistake-free processing achieve a beneficial shortening of the time of the loading and unloading process and thus also boost the throughput of the containers handled.

The loading of a transport vehicle with a container occurs by the stepwise working of steps a) through f) of claim 1. Carrying out the work steps results in a shortening of the loading time of transport vehicles for standard containers, resulting in boosted throughput of the container handling yard. The resulting profitable time savings of the loading process comes from the individual savings accomplished by automating the work steps. At the same time, the number of mistake situations is reduced, which likewise has profitable impact on the throughput.

< > from page 9

It is advantageous that the transport vehicle or the container being unloaded is identified and the thus-generated data are transmitted to the DP system of the logistical management. At the same time, the DP system of the logistical management generates a loading order or unloading order for the stacker crane. This loading order contains the job for the stacker crane to pick up the container being loaded in the container yard and put it down on the loading platform of the transport vehicle, so as to load the transport vehicle in this way. 2< >2 from page 9. The time advantage created by having parallel work steps contributes to shorten the duration of the loading process, as does the fewer mistakes when detecting and transmitting the vehicle data.

Furthermore, it is beneficial that identification points defined by means of a calibrated camera system on the loading platform of the transport vehicle or the container and their coordinates are transmitted to the DP system of the logistical management. From the identification points, the DP system determines the coordinates of the means of fastening of the transport vehicle or of the container being unloaded (the corresponding system of coordinates

describes at least a space reached by the fastening means of the load suspension device of the stacker crane). This method enables a quick and error-free detection of the position of the fastening means for the container or of the container itself, contributing to reduce the loading time for a transport vehicle.

It is especially advantageous for the DP system of the logistical management to compare the coordinates of the identification points with data about the container being loaded, which is stored in the DP system, and determine the fastening means being assigned to this container and the position coordinates on the loading platform of the transport vehicle. The coordinates stored in the DP system as to the size of the container can be compared in good time with the coordinates determined for the fastening means of the transport vehicle. If the size of the loading platform of the transport vehicle is sufficient for the container being loaded, the fastening means of the transport vehicle to be assigned will be determined. In the event that the loading platform of the transport vehicle is not large enough for the container being loaded, a premature termination of the loading process/loading order can occur, or the time-intensive picking up of the container from the container yard by the stacker crane can be prevented in good time, which represents a considerable time savings.

After the successful detecting of the coordinates of the fastening means, the loading process can begin at once for the transport vehicle located in the parking position. For this, the stacker crane travels under computer control with the container being loaded above the loading platform of the transport vehicle, overlapping it exactly, and above the position coordinates. The immediate and exact positioning of the stacker crane above the transport vehicle reduces the duration of the loading process thanks to elimination of the manual "approach".

3< >3 from page 10

The fastening means of the loading platform or the container are detected by means of a calibrated camera system mounted on the stacker crane, and the load suspension device or the container is moved so that the fastening means of the container or load suspension device stands congruently above the assigned fastening means of the loading platform or the container. This enables a rapid, error-free, and correct orientation of the container with respect to the loading platform and of the load suspension device with respect to the container. In contrast with the previous method, the time-intense "approach" of the container or of the load suspension device by an operator present in the parking position is eliminated. It is advantageous that the visual monitoring can thus occur from a remote operator,

who watches the picture of at least one camera. Likewise, the uninterrupted sequence of the individual process steps helps reduce the loading time.

Thanks to the exact orientation of the container with respect to the loading platform, the container can be put down on the loading platform of the transport vehicle in such a way that the fastening means of the container mate with the corresponding fastening means of the loading platform at the end of the lowering process. The disadvantageous "approach" of the load suspension device with the container, guided by an operator present on site, is eliminated and thus produces a beneficial time savings. The container is deposited by the load suspension device on the transport vehicle and released. The loading ~~job~~ of the stacker crane is finished.

4< >4 from page 11

It is especially profitable that an operator does not have to be on site before, during and after the loading process or unloading process. Thus, an operator is available for other activities.

It is especially advantageous that the transport vehicle and possibly the container being unloaded is identified by means of a camera system. By elimination of visual and manual identification, the resulting data are transmitted faster and free of error to the DP system of the logistical management.

For detection of the coordinates of the identification points of the loading platform or of the container, an operator supported by a user-defined interface on a monitor screen of the DP system of the logistical management uses a marking mechanism to select the identification points of the loading platform or of the container on the user-defined interface. The user-defined interface shows the image of the camera system. An operator who selects the identification points of the loading platform or of the container of the transport vehicle or container represented on the user-defined interface with the marking mechanism, contributes to the error-free detection and quick calculation of the coordinates of the fastening means of the loading platform of the transport vehicle.

Another automation which reduces the loading time or unloading time can be accomplished in that the coordinates of the identification points of the loading platform or of the container

are automatically detected by a computer system and transmitted to the logistical management.

The process step described in claim 1 or claim 2 for determination of the position coordinates can be implemented in two different ways. First, it is advantageous to detect the coordinates of the loading platform or of the container of the transport vehicle in the loading and unloading zone. At this time, the transport vehicle is already identified and the assigned container is likewise known by virtue of the loading order. This allows the DP system of the logistical management to recognize early on whether the transport vehicle is suitable to accommodate the container being loaded. If the fastening means of the loading platform of a transport vehicle are successfully assigned, the loading process will continue; otherwise, the loading process, if already started, will be interrupted.

In the event that the detection of the coordinates of the loading platform of the transport vehicle occurs in the final loading and unloading zone, the position coordinates described by the vertical position of the loading platform or the upper edge of the identification points of the container and by the intersection of the diagonals of the identification points of the loading platform, are the absolute target position of the container. The arrangement is thus extremely adroit and enables a quick and thus time-saving positioning of the automatic stacker crane with or without the container above the loading platform being loaded or above the container being unloaded.

Equally advantageous is the other embodiment of the invention of the process step described in claim 1 for determining the position coordinates. The detection of the coordinates of the loading platform of the transport vehicle or of the container in this case occurs in the identification zone. This allows the DP system of the logistical management to recognize early on whether the transport vehicle is suitable to accommodate the container being loaded. Once the fastening means of the loading platform of the transport vehicle are successfully assigned, the loading process will continue; otherwise, the loading process, if already started, will be interrupted.

Since the detection of the coordinates of the loading platform of the transport vehicle occurs in the identification zone, the coordinates detected for the loading platform refer to the transport vehicle. Thus, the vertical position of the loading platform and

the intersection of the diagonals of the identification points of the loading platform describe the relative target position of the container.

5< >5 from page 12

The coordinates of the loading platform or of the container that are detected in the identification zone refer to the transport vehicle and consequently describe the relative target position of the container or of the load suspension device. Advantageously, the position coordinate is described by the absolute target position of the container or of the load suspension device, which is composed of the coordinates determined by means of a camera for the transport vehicle located in the parking position and the relative target position of the container or of the load suspension device. The coordinates already detected [in the] identification zone are linked to the position of the transport vehicle identified in the parking position by the DP system of the logistical management. The result of this linkage is the position coordinate, which is the absolute target position of the container or of the load suspension device. This enables an adroit and thus time-saving positioning of the automatic stacker crane with the container above the loading platform being loaded or the container being unloaded, as is described hereafter.

Regardless of where the detection of the coordinates occurs, a wrong position of one or more fastening means will be evident on the user-defined interface of the DP system. The operator recognizes the wrong positions and consequently notifies the driver of the transport means. He will correct any wrong positions of the fastening means in good time.

Regardless of the way chosen to detect the coordinates, the advantageous choice of the position coordinate will enable the load suspension device to move the container or of the load suspension device into the range of the loading platform or the container, so that the intersection of the diagonals of the fastening means of the container or of the load suspension device stands congruent and plumb above the intersection of the diagonals of the fastening means of the loading platform or the container. The container hanging from the stacker crane or of the load suspension device is thus situated in the middle above the loading platform or the container and must consequently be oriented in the possibly next work step by a rotary movement of the container hanging from the load suspension device or of the load suspension device. For this, the stacker crane need not travel any further, i.e., the bridge of an ACS and the trolley moving on it have already reached their exact final loading position. In advantageous manner, the stepwise approach of the load suspension device, guided by an operator, is eliminated. This procedure enormously simplifies the positioning of the load suspension device or that of the stacker crane and thus contributes to an extremely large reduction in the required

loading time or unloading time.

The simple watching of the loading process or unloading process by an operator is granted by a second user-defined interface with four quadrants, each of them representing a pair of fastening means, while each pair consists of a fastening means of the loading platform or of the container, projected by an image from the camera system, and the associated fastening means of the container or of the load suspension device, projected by a superimposing of a computer-calculated contour of the container or of the load suspension device and of the fastening means onto the image. Thus, the operator comfortably watches the loading process or unloading process, without having to be present at the parking position.

It is an exceptional benefit of the present invention that any deviation between the position of the container being loaded and the position of the loading platform or that of the load suspension device and the container being unloaded can be determined in the DP system of the logistical management for a fine-tuned positioning, in that the second user-defined interface of the logistical management has a marking mechanism with which the operator selects at least one identification point of the loading platform or of the container. The thus-determined exact orientation of the loading platform or of the container is needed to orient the container with respect to the loading platform or the load suspension device. A deviation of the orientations recognized by the DP system of the logistical management results, during the next step of the work sequence, in a correcting of the position of the container or of the load suspension device. The simple detecting of the position of the loading platform or the container, the direct availability of the data in the DP system of the logistical management, and the excluding of errors from the data result in an exceptional time savings.

Just as advantageous is the configuring of the invention so that any deviation in position of the container being loaded with respect to the position of the loading platform or that of the load suspension device with respect to the container being unloaded is automatically recognized by a computer system for fine positioning.

When a deviation exists in the position of the container being loaded with respect to the position of the loading platform or that of the load suspension device with respect to the container being unloaded, the container or the load suspension device is turned so that the fastening means of the container or of the load suspension device stand congruently and plumb above the fastening means of the loading platform or the container. Such a fast and correct orienting of the container with respect to the loading platform or of the load suspension device with respect to the container occurs automatically,

based on the computed deviation. It is unusually advantageous that a tilting of the transport vehicle in its lengthwise and/or transverse direction, caused for example by uneven ground, does not have harmful impact on the loading process. The stepwise approach of the load suspension device with or without the container relative to the loading platform or the container is eliminated, which produces an exceptional reduction in the time required for the loading or unloading of a transport vehicle.

The swift setting down and releasing of the container from the load suspension device or the swift approach of the load suspension device to pick up the container until the fastening means lock together is guided by an operator or automatically by a computer system. Since the container or the load suspension device is exactly located above the loading platform or the container, and is correctly oriented, and the DP system has determined the vertical position of the loading platform or of the container, an immediate and continuous motion for depositing the container or the load suspension device can be carried out, and it can be concluded sooner than the manual "approach". The locking together of the fastening means of the container and those in the loading platform completes the deposit of the container. After the load suspension device is no longer loaded with the container, which is indicated by the triggering of pressure sensors, the container can be released from the load suspension device and fastened to the transport vehicle.
6< >6 from page 14
<The unloading of the transport vehicle loaded with a container is described by the sequential working of steps a) through f) of claim 2. The carrying out of the work steps produces a shortening of the unloading time of transport vehicles for standard containers, leading to an increased throughput of the container handling yard. The resulting profitable time savings of the unloading process consists of the individual savings achieved by automating the work steps. At the same time, the number of mistake situations is reduced, which likewise has profitable impact on the throughput. >

~~It is advantageous that the transport vehicle and the container being unloaded are identified and the thus-generated data are transmitted to the DP system of the logistical management. At the same time, the DP system of the logistical management generates an unloading order for the stacker crane~~. 2<This unloading order contains the job for the stacker crane to pick up the container being unloaded from the transport vehicle and store it in the container yard.>2 ~~The time advantage created by having parallel work steps contributes to~~

~~shorten the duration of the loading process, as does the fewer mistakes when detecting and transmitting the vehicle data.~~

~~Furthermore, it is beneficial that identification points defined by means of a calibrated camera system on the container and their coordinates are transmitted to the DP system of the logistical management. From the identification points, the DP system determines the coordinates of the means of fastening of the container being unloaded (the corresponding system of coordinates describes at least a space reached by the fastening means of the load suspension device of the stacker crane). This method enables a quick and error-free detection of the position of the fastening means of a container and thus contributes to reduce the unloading time for a transport vehicle.~~

3< It is especially advantageous for the DP system of the logistical management to determine the fastening means and position coordinates of the container from the identification points. This enables a quick and error-free calculation of the position coordinates, for the immediate starting of the unloading order for the transport vehicle.

For this, the stacker crane travels under computer control above the container, overlapping it exactly, and above the position coordinates. The immediate and exact positioning of the load suspension device above the container being unloaded reduces the time of the unloading process by eliminating the manual "approach".>3

~~The fastening means of the container are detected by means of a calibrated camera system mounted on the stacker crane, and the load suspension device is moved so that the fastening means of the container or of the load suspension device stands congruently above the assigned fastening means of the container. This enables a rapid, error-free, and correct orientation of the load suspension device with respect to the container. In contrast with the previous method, the time-intense "approach" of the load suspension device by an operator present in the parking position is eliminated. It is advantageous that the visual monitoring can thus occur from a remote operator, who watches the picture of at least one camera. Likewise,~~

~~the uninterrupted sequence of the individual process steps helps reduce the loading time.~~

4<Thanks to the fast and exact orienting of the fastening means of the load suspension device with respect to the container, the load suspension device can be brought up to the container in such a way that the fastening means of the load suspension device mate with the fastening means of the container. The disadvantageous "approaching" of the load suspension device to the container, guided by an operator, is eliminated and thus produces an advantageous time savings. The container is removed from the transport vehicle and can be unloaded by the load suspension device, which then stores it temporarily in the container yard. The unloading job of the stacker crane is thus finished. >4

~~It is especially profitable that an operator does not have to be on site before, during and after the unloading process. Thus, an operator is available for other activities.~~

~~It is especially advantageous that the transport vehicle and the container being unloaded is identified by means of a camera system. By elimination of visual and manual identification, the resulting data are transmitted faster and free of error to the DP system of the logistical management.~~

~~For detection of the coordinates of the identification points of the container, an operator supported by a user-defined interface on a monitor screen of the DP system of the logistical management uses a marking mechanism to select the identification points of the container on the user-defined interface. The user-defined interface shows the image of the camera system. An operator who selects the identification points of the container represented on the user-defined interface with the marking mechanism, contributes to the error-free detection and quick calculation of the coordinates of the fastening means of the loading platform of the transport vehicle.~~

~~Another automation which reduces the unloading time can be accomplished in that the coordinates of the identification points of the container are automatically detected by a computer system and transmitted to the logistical management.~~

~~The process step described in claim 2 for determination of the position coordinates can be implemented in two different ways. First, it is advantageous to detect the coordinates of the container in the loading and unloading zone. The position coordinate, which is described by the vertical position of the upper edge of the identification points of the container and by the point of intersection of the diagonals of the identification points of the loading platform, [is?] the absolute target position of the container. The arrangement is thus extremely adroit and enables a quick and thus time-saving positioning of the automatic stacker crane with the load fastening means above the container being unloaded.~~

~~Equally advantageous is the other embodiment of the invention of the process step described in claim 2 for determining the position coordinates. The detection of the coordinates [of the] container in this case occurs in the identification zone.~~ 5<The position coordinate of the container is described by the vertical position of the upper edge of the identification points of the container and by the intersection of the diagonals of the identification points of the container, which describes the relative target position of the container. By selecting the upper edge of the identification points (fastening means) of the container as an element of the position coordinate, one can also unload standard containers not having a cover, such as open-top containers, tank containers and/or flat containers. Thus, the favorable choice of the position coordinate enables an adroit and thus time-saving positioning of the automatic stacker crane above the container being unloaded.>5 , ~~which shall be described hereafter.~~

~~The coordinates of the container that are detected in the identification zone refer to the transport vehicle and consequently describe the relative target position of the load suspension device. Advantageously, the position coordinate is described by the absolute target position of the load suspension device, which is composed of the coordinates determined by means of a camera for the transport vehicle located in the parking position and the relative target position of the load suspension device. The coordinates already detected [in the] identification zone are linked to the position of the transport vehicle identified in the parking position by the DP system of the logistical management. The result of this linkage is the position coordinate, which is the absolute target position of the load suspension device. This enables an adroit and thus time-saving positioning of the automatic stacker crane~~

~~above the container being unloaded, as is described hereafter.~~

~~Regardless of the way chosen to detect the coordinates, the advantageous choice of the position coordinate will enable the load suspension device to be moved into the range of the container, so that the intersection of the diagonals of the fastening means of the load suspension device stands plumb above the intersection of the diagonals of the fastening means of the container. Thus, the load suspension device crane is situated in the middle above the container and must consequently be oriented in the possibly next work step by a rotary movement of the load suspension device. For this, the stacker crane need not travel any further, i.e., the bridge of an ACS and the trolley moving on it have already reached their exact final unloading position. In advantageous manner, the stepwise approach of the load suspension device, guided by an operator, is eliminated. This procedure enormously simplifies the positioning of the stacker crane and thus contributes to an extremely large reduction in the required unloading time.~~

~~The simple watching of the unloading process by an operator is granted by a second user defined interface with four quadrants, each of them representing a pair of fastening means, while each pair consists of a fastening means of the container, projected by an image from the camera system, which is situated on the load suspension device, and of the associated fastening means of the load suspension device, projected by a superimposing of a computer calculated contour of the load suspension device and of its fastening means onto the image. Thus, the operator comfortably watches the unloading process, without having to be present at the parking position.~~

~~It is an exceptional benefit of the present invention that any deviation between the position of the load suspension device and the position of the container being unloaded can be determined in the DP system of the logistical management for a fine tuned positioning, in that the second user defined interface of the logistical management has a marking mechanism with which the operator selects at least one identification point of the container. The thus determined exact orientation of the container is needed to orient the load suspension device. A deviation of the orientations recognized by the DP system of the logistical management~~

~~results, during the next step of the work sequence, in a correcting of the position of the fastening means of the load suspension device. The simple detecting of the position of the container, the direct availability of the data in the DP system of the logistical management, and the reducing of errors in the data result in an exceptional time savings.~~

~~Just as advantageous is the configuring of the invention so that any deviation in position of the load suspension device with respect to the position of the container being unloaded is automatically recognized by a computer system for fine positioning.~~

~~When a deviation exists in the position of the load suspension device with respect to the container being unloaded, the load suspension device is turned so that the fastening means of the load suspension device stand congruently and plumb above the fastening means of the container. Such a fast and correct orienting of the load suspension device with respect to the container occurs automatically, based on the computed deviation. The stepwise approach of the load suspension device relative to the container is eliminated, which produces an exceptional reduction in the time required for the unloading of a transport vehicle.~~

~~The swift and continuous approach of the load suspension device to pick up the container and the locking together of the fastening means is guided by an operator or automatically by a computer system. Since the load suspension device is exactly located above the container and is correctly oriented, and the DP system has determined the vertical position of the container, an immediate and continuous motion for depositing the load suspension device can be carried out, and it can be concluded sooner than the manual "approach".~~
6<The locking together of the fastening means of the load suspension device and those in the container completes the picking up of the container. The container is fastened to the load suspension device and the stacker crane places it in the container yard for temporary storage. Thus, the unloading job order is complete.>6

The continuous sequence of process steps enables a fast loading and unloading of a transport vehicle. The time

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From European patent application EP 1 043 262 A1 there is already known a method for handling of standard containers at a container yard. This container yard has a controllable stacker crane for the containers, which can travel between a storage position for the container and a transport vehicle with a loading platform for the container. The stacker crane is provided with a means of picking up the load in order to set the container down on the loading platform or pick it up from the platform, such as can be oriented with respect to the container and the loading platform. The stacker crane also has a horizontally moveable trolley with a lifting mechanism, from which is suspended the means of picking up the container. On this load suspension device is arranged a sensor in the form of a video camera system, so as to automatically place the load suspension device on the container or pick up the container from the loading platform. Furthermore, a second sensor also in the form of a video camera system is fastened to the load suspension device, in order to adjust the stacker crane. The reference point for this is a wall with optical elements, which is arranged in the region of the parking place of the transport vehicle.

Furthermore, there is also already known from the international patent application WO 01/81233 A1 a system for orienting a load suspension device for containers. The load suspension device, designed as a spreader, has a CCD camera in the region of its twistlocks for fastening the spreader to the corner points of a container. Thanks to the video signal obtained from the camera, an operator can thus set this spreader down in true position on a container in relation to its support points. This system can also work automatically in conjunction with a DP system.